

# TEST REPORT

|                                                                                                                                               |                            |                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>KOSTEC Co., Ltd.</b><br>28(175-20, Annyeong-dong) 406-gil sejaro,<br>Hwaseong-si, Gyeonggi-do, Korea<br>Tel:031-222-4251, Fax:031-222-4252 | Report No.: KST-FCR-170004 |  <b>KOSTEC Co., Ltd.</b><br><a href="http://www.kostec.org">http://www.kostec.org</a> |
|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

1. Applicant

- Name : Midland Radio Corporation
- Address : 5900 Parretta Drive, Kansas City, Missouri United States 64120

2. Test Item

- Product Name: GMRS/FRS
- Model Name: XT511A
- Brand: Base Camp Radio
- FCC ID: MMAXT511A                      • IC : 3690A-XT511A

3. Manufacturer

- Name : Global Link Corporation Ltd.
- Address : 21/F Kolling Centre, 77-79 Granville Road, Tsim Sha Tsui Kowloon, Hong Kong

4. Date of Test : 2017. 07. 03. ~ 2017. 07. 04.

FCC CFR 47, Part 95  
RSS-GEN

5. Test Method Used : RSS-210 Issue 9  
ANSI/TIA-603-E-2016  
ANSI C63.4-2014

6. Test Result : Compliance

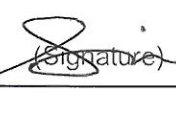
7. Note: None

**Supplementary Information**

The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with measurement procedures specified in ANSI/TIA-603-E-2016.

We attest to the accuracy of data and all measurements reported herein were performed by KOSTEC Co., Ltd. and were made under Chief Engineer's supervision. We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

|             |                                                                                                                                   |                                                                                                                                                  |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Affirmation | Tested by<br>Name : Lee, Mi-Young  (Signature) | Technical Manager<br>Name : Park, Gyeong-Hyeon  (Signature) |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|

2017. 07. 06.

**KOSTEC Co., Ltd.**

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## 1. GENERAL INFORMATION

### 1.1 Test Facility

#### Test laboratory and address

KOSTEC Co., Ltd.

128(175-20,Annyeong-dong)406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea

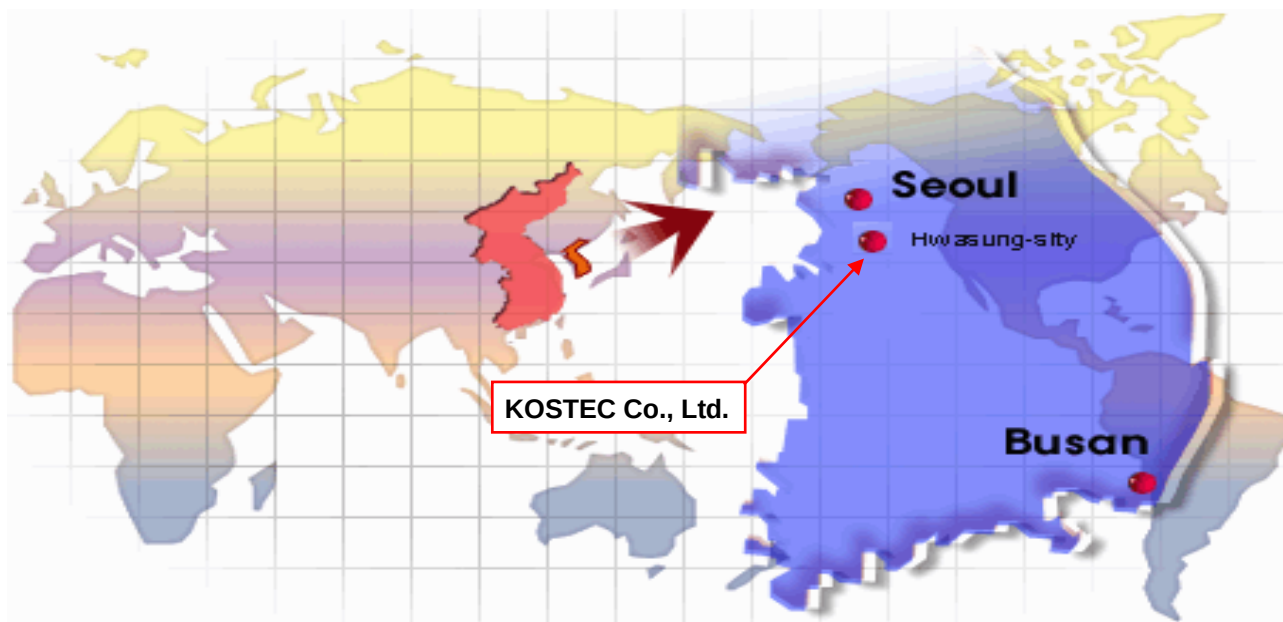
#### Registration information

KOLAS No. : 232

FCC Designation No. : KR0041

IC Registration Site No. : 8305A-1

### 1.2 Location



### 1.3 Revision History of test report

| Rev. | Revisions     | Effect page | Reviewed           | Date          |
|------|---------------|-------------|--------------------|---------------|
| -    | Initial issue | All         | Gyeong Hyeon, Park | 2017. 07. 06. |
|      |               |             |                    |               |

## 2. EQUIPMENT DESCRIPTION

The product specification described herein was declared by manufacturer. And refer to user's manual for the details.

|                                |                                                                                                                                               |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment Name                 | GMRS / FRS                                                                                                                                    |
| Model No                       | XT511A                                                                                                                                        |
| Usage                          | Family Radio Face Held Transmitter                                                                                                            |
| Intended Operating Environment | General population/Uncontrolled exposure                                                                                                      |
| Serial Number                  | A1709001000                                                                                                                                   |
| Primary User Functions of EUT  | 2-Way Wireless Voice Communication                                                                                                            |
| Rated output power             | 1.6 W (GMRS) / 0.2 W (FRS)                                                                                                                    |
| Max. E.R.P                     | 1.5 W (GMRS) / 0.2 W (FRS)                                                                                                                    |
| Operating Frequency Range      | GMRS/FRS : 462.562 5 MHz - 462.712 5 MHz<br>FRS : 467.562 5 MHz - 467.712 5 MHz<br>GMRS : 462.550 0 MHz - 462.725 0 MHz                       |
| Channel Number                 | 22 EA                                                                                                                                         |
| Channel Spacing                | 12.5 kHz                                                                                                                                      |
| Modulation                     | FM                                                                                                                                            |
| Occupied Bandwidth (99%)       | 9.93 kHz(GMRS) / 9.93 kHz(FRS)                                                                                                                |
| Emission Designation           | 11K0F3E                                                                                                                                       |
| Power Source                   | Ni-MH battery pack / 6.0 VDC nominal / 700 mAh                                                                                                |
| Antenna Description            | Fixed external antenna, 0.45 dBi                                                                                                              |
| FCC ID                         | MMAXT511A                                                                                                                                     |
| IC                             | 3690A-XT511A                                                                                                                                  |
| Remark                         | The above DUT's information was declared by manufacturer.<br>Please refer to the specifications or user manual for more detailed description. |

### 3. SYSTEM CONFIGURATION FOR TEST

#### 3.1 Characteristics of equipment

GMRS / FRS

#### 3.2 Used peripherals list

| Description          | Model No. | Serial No. | Manufacture               | Remark |
|----------------------|-----------|------------|---------------------------|--------|
| AC-DC Adaptor        | U090030D  | None       | Midland Radio Corporation |        |
| Rechargeable Battery | BATT-5R   | None       | Midland Radio Corporation |        |
| Ear/Mic              | None      | None       | Midland Radio Corporation |        |
|                      |           |            |                           |        |

#### 3.3 Product Modification

N/A

#### 3.4 Operating Mode

Constantly transmitting with a carrier at maximum power.

#### 3.5 Test Setup of EUT



### 3.6 Table for Carrier Frequencies

| Channel | Freq. [MHz] | Description | Channel | Freq. [MHz] | Description |
|---------|-------------|-------------|---------|-------------|-------------|
| 1       | 462.5625    | GMRS        | 12      | 467.6625    | FRS         |
| 2       | 462.5875    | GMRS        | 13      | 467.6875    | FRS         |
| 3       | 462.6125    | GMRS        | 14      | 467.7125    | FRS         |
| 4       | 462.6375    | GMRS        | 15      | 462.5500    | GMRS        |
| 5       | 462.6625    | GMRS        | 16      | 462.5750    | GMRS        |
| 6       | 462.6875    | GMRS        | 17      | 462.6000    | GMRS        |
| 7       | 462.7125    | GMRS        | 18      | 462.6250    | GMRS        |
| 8       | 467.5625    | FRS         | 19      | 462.6500    | GMRS        |
| 9       | 467.5875    | FRS         | 20      | 462.6750    | GMRS        |
| 10      | 467.6125    | FRS         | 21      | 462.7000    | GMRS        |
| 11      | 467.6375    | FRS         | 22      | 462.7250    | GMRS        |

Conclusion of worst-case for each mode of representative channel respectively

The EUT has 2 type of mode (GMRS and FRS). Each conducted output power as following;

Therefore all applicable requirements were tested to the two channels, the 22th for GMRS and the 14th for FRS.

| Channel Description | CH | Frequency [MHz] | Conducted Power |             |
|---------------------|----|-----------------|-----------------|-------------|
|                     |    |                 | [dBm]           | [W]         |
| GMRS                | 1  | 462.5625        | 31.52           | 1.42        |
|                     | 2  | 462.5875        | 31.36           | 1.37        |
|                     | 3  | 462.6125        | 31.36           | 1.37        |
|                     | 4  | 462.6375        | 31.36           | 1.37        |
|                     | 5  | 462.6625        | 31.36           | 1.37        |
|                     | 6  | 462.6875        | 31.36           | 1.37        |
|                     | 7  | 462.7125        | 31.36           | 1.37        |
| FRS                 | 8  | <b>467.5625</b> | <b>23.19</b>    | <b>0.21</b> |
|                     | 9  | 467.5875        | 22.86           | 0.19        |
|                     | 10 | 467.6125        | 22.86           | 0.19        |
|                     | 11 | 467.6375        | 23.02           | 0.20        |
|                     | 12 | 467.6625        | 22.86           | 0.19        |
|                     | 13 | 467.6875        | 23.02           | 0.20        |
|                     | 14 | 467.7125        | 22.86           | 0.19        |
| GMRS                | 15 | <b>462.5500</b> | <b>31.52</b>    | <b>1.42</b> |
|                     | 16 | 462.5750        | 31.36           | 1.37        |
|                     | 17 | 462.6000        | 31.36           | 1.37        |
|                     | 18 | 462.6250        | 31.36           | 1.37        |
|                     | 19 | 462.6500        | 31.36           | 1.37        |
|                     | 20 | 462.6750        | 31.36           | 1.37        |
|                     | 21 | 462.7000        | 31.36           | 1.37        |
|                     | 22 | 462.7250        | 31.36           | 1.37        |

### 3.7 Used Test Equipment List

| No. | Instrument                    | Model        | S/N          | Manufacturer               | Due to cal date | Cal interval | used                                |
|-----|-------------------------------|--------------|--------------|----------------------------|-----------------|--------------|-------------------------------------|
| 1   | T & H Chamber                 | EY-101       | 90E14260     | TABAI ESPEC                | 2017.09.07      | 1 year       | <input checked="" type="checkbox"/> |
| 2   | T & H Chamber                 | SH-641       | 92006831     | ESPEC CORP                 | 2018.05.31      | 1 year       | <input type="checkbox"/>            |
| 3   | Spectrum Analyzer             | 8563E        | 3846A10662   | Agilent Technology         | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 4   | Spectrum Analyzer             | 8593E        | 3710A02859   | Agilent Technology         | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 5   | Spectrum Analyzer             | FSV30        | 20-353063    | Rohde & Schwarz            | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 6   | Signal Analyzer               | N9010A       | MY56070441   | Agilent Technologies       | 2018.05.15      | 1 year       | <input checked="" type="checkbox"/> |
| 7   | EMI Test Receiver             | ESCI7        | 100823       | Rohde & Schwarz            | 2018.01.31      | 1 year       | <input checked="" type="checkbox"/> |
| 8   | EMI Test Receiver             | ESI          | 837514/004   | Rohde & Schwarz            | 2017.09.07      | 1 year       | <input checked="" type="checkbox"/> |
| 9   | Vector Signal Analyzer        | 89441A       | 3416A02620   | Agilent Technology         | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 10  | Network Analyzer              | 8753ES       | US39172348   | AGILENT                    | 2017.09.06      | 1 year       | <input type="checkbox"/>            |
| 11  | EPM Series Power meter        | E4418B       | GB39512547   | Agilent Technology         | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 12  | RF Power Sensor               | E9300A       | MY41496631   | Agilent Technology         | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 13  | Microwave Frequency Counter   | 5352B        | 2908A00480   | Agilent Technology         | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 14  | Modulation Analyzer           | 8901A        | 3538A07071   | Agilent Technology         | 2018.02.02      | 1 year       | <input checked="" type="checkbox"/> |
| 15  | Audio Analyzer                | 8903B        | 3514A16919   | Agilent Technology         | 2018.01.31      | 1 year       | <input checked="" type="checkbox"/> |
| 16  | Audio Telephone Analyzer      | DD-5601CID   | 520010281    | CREDIX                     | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 17  | Digital storage Oscilloscope  | TDS3052      | B015962      | Tektronix                  | 2017.09.06      | 1 year       | <input type="checkbox"/>            |
| 18  | ESG-D Series Signal Generator | E4436B       | US39260458   | Agilent Technology         | 2018.02.02      | 1 year       | <input checked="" type="checkbox"/> |
| 19  | Vector Signal Generator       | SMBV100A     | 257557       | Rohde & Schwarz            | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 20  | Signal Generator              | SMB100A      | 179628       | Rohde & Schwarz            | 2018.05.18      | 1 year       | <input checked="" type="checkbox"/> |
| 21  | Tracking Source               | 85645A       | 070521-A1    | Agilent Technology         | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 22  | SLIDAC                        | None         | 0207-4       | Myoung sung Ele.           | 2018.01.31      | 1 year       | <input type="checkbox"/>            |
| 23  | DC Power supply               | DRP-5030     | 9028029      | Digital Electronic Co.,Ltd | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 24  | DC Power supply               | 6038A        | 3440A12674   | Agilent Technology         | 2018.01.31      | 1 year       | <input checked="" type="checkbox"/> |
| 25  | DC Power supply               | E3610A       | KR24104505   | Agilent Technology         | 2018.01.31      | 1 year       | <input type="checkbox"/>            |
| 26  | DC Power supply               | UP-3005T     | 68           | Unicon Co.,Ltd             | 2018.01.31      | 1 year       | <input type="checkbox"/>            |
| 27  | DC Power Supply               | SM 3004-D    | 114701000117 | DELTA ELEKTRONIKA          | 2018.01.31      | 1 year       | <input type="checkbox"/>            |
| 28  | Dummy Load                    | 8173         | 3780         | Bird Electronic Co., Corp  | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 29  | Attenuator                    | 50FH-030-500 | 140410 9433  | JEW Industries Inc.        | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 30  | Attenuator                    | 765-20       | 9703         | Narda                      | 2017.09.06      | 1 year       | <input type="checkbox"/>            |
| 31  | Attenuator                    | 24-30-34     | BX5630       | Aeroflex / Weinschel       | 2017.12.27      | 1 year       | <input type="checkbox"/>            |
| 32  | Attenuator                    | 8498A        | 3318A09485   | HP                         | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 33  | Step Attenuator               | 8494B        | 3308A32809   | HP                         | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 34  | Attenuator                    | 18B50W-20F   | 64671        | INMET                      | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 35  | Attenuator                    | 10 dB        | 1            | Rohde & Schwarz            | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 36  | Attenuator                    | 10 dB        | 2            | Rohde & Schwarz            | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 37  | Attenuator                    | 10 dB        | 3            | Rohde & Schwarz            | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 38  | Attenuator                    | 10 dB        | 4            | Rohde & Schwarz            | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 39  | Attenuator                    | 54A-10       | 74564        | WEINSCHTEL                 | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 40  | Attenuator                    | 56-10        | 66920        | WEINSCHTEL                 | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 41  | Power divider                 | 11636B       | 51212        | HP                         | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 42  | 3Way Power divider            | KPDSU3W      | 00070365     | KMW                        | 2017.09.06      | 1 year       | <input type="checkbox"/>            |
| 43  | 4Way Power divider            | 70052651     | 173834       | KRYTAR                     | 2018.02.01      | 1 year       | <input type="checkbox"/>            |
| 44  | 3Way Power divider            | 1580         | SQ361        | WEINSCHTEL                 | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 45  | OSP                           | OSP120       | 101577       | Rohde & Schwarz            | 2018.05.19      | 1 year       | <input type="checkbox"/>            |
| 46  | White noise audio filter      | ST31EQ       | 101902       | SoundTech                  | 2017.09.07      | 1 year       | <input type="checkbox"/>            |
| 47  | Dual directional coupler      | 778D         | 17693        | HEWLETT PACKARD            | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 48  | Dual directional coupler      | 772D         | 2839A00924   | HEWLETT PACKARD            | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 49  | Band rejection filter         | 3TNF-0006    | 26           | DOVER Tech                 | 2018.02.03      | 1 year       | <input checked="" type="checkbox"/> |
| 50  | Band rejection filter         | 3TNF-0008    | 317          | DOVER Tech                 | 2018.02.03      | 1 year       | <input type="checkbox"/>            |

| No. | Instrument                          | Model                            | S/N         | Manufacturer                | Due to cal date | Cal interval | used                                |
|-----|-------------------------------------|----------------------------------|-------------|-----------------------------|-----------------|--------------|-------------------------------------|
| 51  | Band rejection filter               | 3TNF-0007                        | 311         | DOVER Tech                  | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 52  | Band rejection filter               | WTR-BRF2442-84NN                 | 09020001    | WAVE TECH Co.,LTD           | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 53  | Band rejection filter               | WRCJV12-5695-5725-5825-5855-50SS | 1           | Wainwright Instruments GmbH | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 54  | Band rejection filter               | WRCJV12-5120-5150-5350-5380-40SS | 4           | Wainwright Instruments GmbH | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 55  | Band rejection filter               | WRCGV10-2360-2400-2500-2540-50SS | 2           | Wainwright Instruments GmbH | 2018.05.18      | 1 year       | <input type="checkbox"/>            |
| 56  | Highpass Filter                     | WHJS1100-10EF                    | 1           | WAINWRIGHT                  | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 57  | Highpass Filter                     | WHJS3000-10EF                    | 1           | WAINWRIGHT                  | 2018.02.02      | 1 year       | <input type="checkbox"/>            |
| 58  | Highpass Filter                     | WHNX6-5530-3000-26500-40CC       | 2           | Wainwright Instruments GmbH | 2018.05.19      | 1 year       | <input type="checkbox"/>            |
| 59  | Highpass Filter                     | WHNX6-2370-7000-26500-40CC       | 4           | Wainwright Instruments GmbH | 2018.05.19      | 1 year       | <input type="checkbox"/>            |
| 60  | WideBand Radio Communication Tester | CMW500                           | 102276      | Rohde & Schwarz             | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 61  | Radio Communication Tester          | CMU 200                          | 112026      | Rohde & Schwarz             | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 62  | Bluetooth Tester                    | TC-3000B                         | 3000B6A0166 | TESCOM CO., LTD.            | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 63  | RF Up/Down Converter                | DCP-1780                         | 980901003   | CREDIX                      | 2018.02.03      | 1 year       | <input type="checkbox"/>            |
| 64  | DECT Test set                       | CMD60                            | 840677/005  | Rohde & Schwarz             | 2017.09.06      | 1 year       | <input type="checkbox"/>            |
| 65  | Loop Antenna                        | 6502                             | 9203-0493   | EMCO                        | 2019.05.29      | 2 year       | <input type="checkbox"/>            |
| 66  | BiconiLog Antenna                   | 3142B                            | 9910-1432   | EMCO                        | 2018.04.25      | 2 year       | <input checked="" type="checkbox"/> |
| 67  | Trilog-Broadband Antenna            | VULB 9168                        | 9168-606    | SCHWARZBECK                 | 2018.09.09      | 2 year       | <input type="checkbox"/>            |
| 68  | Horn Antenna                        | 3115                             | 2996        | EMCO                        | 2018.02.11      | 2 year       | <input checked="" type="checkbox"/> |
| 69  | Horn Antenna                        | BBHA9170                         | BBHA9170152 | SCHWARZBECK                 | 2019.04.25      | 2 year       | <input type="checkbox"/>            |
| 70  | Antenna Master(3)                   | AT13                             | None        | AUDIX                       | N/A             | N/A          | <input checked="" type="checkbox"/> |
| 71  | Turn Table(3)                       | None                             | None        | AUDIX                       | N/A             | N/A          | <input checked="" type="checkbox"/> |
| 72  | PREAMPLIFIER(3)                     | 8449B                            | 3008A02577  | Agilent                     | 2018.02.01      | 1 year       | <input checked="" type="checkbox"/> |
| 73  | Antenna Master(10)                  | MA4000-EP                        | None        | inno systems GmbH           | N/A             | N/A          | <input checked="" type="checkbox"/> |
| 74  | Turn Table(10)                      | None                             | None        | inno systems GmbH           | N/A             | N/A          | <input checked="" type="checkbox"/> |
| 75  | AMPLIFIER(10)                       | TK-PA6S                          | 120009      | TESTEK                      | 2018.01.31      | 1 year       | <input checked="" type="checkbox"/> |
| 76  | Antenna Mast                        | MA2000-EP                        | None        | inno systems GmbH           | N/A             | N/A          | <input type="checkbox"/>            |
| 77  | Turn Device                         | DE3700-RH                        | None        | inno systems GmbH           | N/A             | N/A          | <input type="checkbox"/>            |

#### 4. SUMMARY TEST RESULTS

| Description of Test                                                                                                                                                                                                                                   | FCC Rule                            | IC Rule                        | Reference Clause | Used                                | Test Result |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------------|------------------|-------------------------------------|-------------|
| RF Output Power                                                                                                                                                                                                                                       | Part 95.639(a)(d)                   | RSS-210 E.2.4<br>RSS-210 E.3.5 | Clause 5.1       | <input checked="" type="checkbox"/> | Compliance  |
| Modulation Characteristics                                                                                                                                                                                                                            | Part 95.637(a)(b)<br>Part 2.1047(a) | RSS-210 E.2.2<br>RSS-210 E.3.2 | Clause 5.2       | <input checked="" type="checkbox"/> | Compliance  |
| Occupied Bandwidth                                                                                                                                                                                                                                    | Part 95.633(a)(c)                   | RSS-210 E.2.3<br>RSS-210 E.3.4 | Clause 5.3       | <input checked="" type="checkbox"/> | Compliance  |
| Emission Mask                                                                                                                                                                                                                                         | Part 95.635(b)(1)(3)(7)             | RSS-210 E.2.5<br>RSS-210 E.3.6 | Clause 5.4       | <input checked="" type="checkbox"/> | Compliance  |
| Frequency Stability                                                                                                                                                                                                                                   | Part 95.621(b)<br>Part 95.627(b)    | RSS-210 E.2.6<br>RSS-210 E.3.7 | Clause 5.5       | <input checked="" type="checkbox"/> | Compliance  |
| Transmitter Radiated Unwanted Emissions                                                                                                                                                                                                               | Part 95.635(b7)                     | RSS-210 E.2.5<br>RSS-210 E.3.6 | Clause 5.6       | <input checked="" type="checkbox"/> | Compliance  |
| <p>Compliance/pass : The EUT complies with the essential requirements in the standard.</p> <p>Not Compliance : The EUT does not comply with the essential requirements in the standard.</p> <p>N/A : The test was not applicable in the standard.</p> |                                     |                                |                  |                                     |             |
| <p><b>Procedure Reference :</b></p> <p>FCC CFR 47, Part 95</p> <p>RSS-GEN</p> <p>RSS-210 Issue 9</p> <p>ANSI/TIA-603-E-2016</p> <p>ANSI C 63.4-2014</p>                                                                                               |                                     |                                |                  |                                     |             |

## 5. MEASUREMENT RESULTS

### 5.1 RF Output Power

#### 5.1.1 Standard Applicable [FCC Part 95.639(a)(d) / RSS-210 A6.1.4,A6.2.4]

**FCC Part 95.639(a)** A GMRS transmitter may transmit with a maximum power of 5.0 W e.r.p.

**FCC Part 95.639(d)** For FRS, the maximum permissible transmitter output power under any operating conditions is 0.5 W effective radiated power (e.r.p.).

**RSS-210 A6.1.4** The maximum permissible transmitter output power under any operating conditions is 0.5 W effective radiated power (e.r.p.). The radio shall be equipped with an integral antenna.

**RSS-210 A6.2.4** A GMRS transmitter may transmit with a maximum power of 2 W e.r.p.

#### 5.1.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) °C
- Relative Humidity : (48 ~ 52) % R.H.

#### 5.1.3 Measurement Procedure

The EUT was setup according to ANSI/TIA-603-E-2016 for compliance to FCC 47CFR part 95 requirements.

As a below test procedure (①~⑧), The result value of measurement is performed to condition of the below; The EUT will operate in continuous transmission mode during the time necessary to perform the measured of the frequency. Substitution method was performed to determine the actual  $P_{erp}$  (or  $P_{eirp}$ ) emission levels of the EUT.

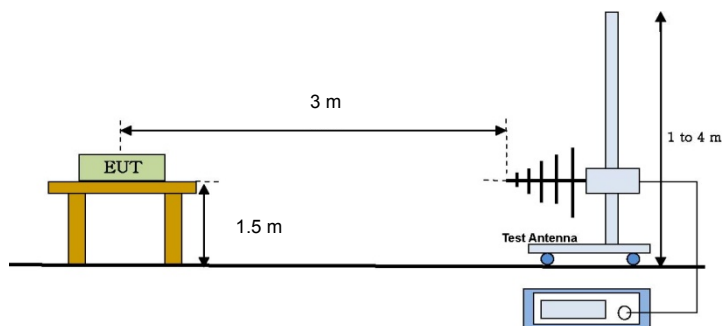
The following test procedure as below;

The test is performed in a fully pyramidal chamber to determine the accurate frequencies, after maximum emissions level will be checked on a test chamber and measuring distance is 3 m from EUT to test antenna.

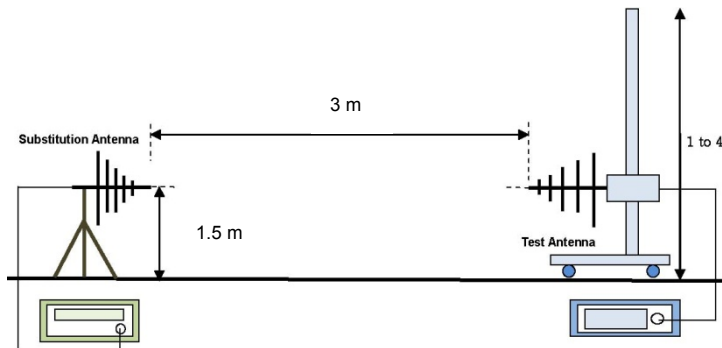
- ① The EUT was set on with continuous transmission mode and placed on a 1.5 meter high non-conductive table on the chamber.
- ② The test antenna is used on Bi-Log antenna at above 30 MHz, and used on Horn antenna at 1 GHz and then the measurements are repeated with the test antenna for vertical and horizontal polarization. The output of the test antenna will be connected to a measuring receiver, and it is set to tuned over the required standard measuring frequency range.
- ③ At each frequency at which a relevant spurious component is detected, the test antenna will be raised and lowered through the specified range of heights until an maximum signal level is detected on the measuring receiver.
- ④ The EUT is position x, y, z axis on rotating through 360 degrees in the horizontal plane, until the Max. signal level is detected by the measuring receiver.
- ⑤ The receiver is scanned from requested measuring frequency band and then the maximum meter reading is recorded. The radiated emissions were measured with requested standard specification (detector and resolution bandwidth etc.)
- ⑥ The EUT was then removed and replaced with substitution antenna .The center of the antenna was approximately at the same location as the center of the EUT, and calibrated for the frequency of the spurious component detected.
- ⑦ Signal generator output port connected with substitution antenna input port. If necessary, may use shield cable between signal generator and substitution antenna
- ⑧ The frequency of the calibrated signal generator is set to frequency of the spurious component detected, and the input attenuator setting of the measuring receiver was adjust in order to increase the sensitivity of the measuring receiver, if necessary

- ⑨ The test antenna was raised and lowered through the specified range of heights to ensure that maximum signal is received.
  - ⑩ The input signal to the substitution antenna was be adjusted until an equal or a known related level to that detected from the transmitter is obtained on the measuring receiver.
  - ⑪ The input signal to the substitution antenna was be recorded as a power level and corrected for any change of input attenuator setting of the measuring receiver
  - ⑫ The measure of  $P_{erp}$ (or  $P_{eirp}$ ) the spurious components is the larger of the two power levels recorded for each spurious component at the input to the substitution antenna, corrected for the gain of the substitution antenna, if necessary.
  - ⑬ It is correction to signal generator's offset value. In this case of  $P_{erp}$ (or  $P_{eirp}$ ) shall calculated as follow as formula ;
- $P_{erp}$ (or  $P_{eirp}$ ) = Signal generator level (dBm) – Cable loss(dB)

### 5.1.5 Test Setup



[ Radiated measurement setup\_Below than 1 GHz]



[ Effective Radiated Power measurement setup]

※ Above the test antenna is used on Horn antenna at above 1 GHz.

### 5.1.5 Measurement Result

| Channel Description | CH | Frequency [MHz] | Effective Radiated Power |     | Limit [W] | Test Results |
|---------------------|----|-----------------|--------------------------|-----|-----------|--------------|
|                     |    |                 | [dBm]                    | [W] |           |              |
| GMRS                | 15 | 462.5500        | 31.8                     | 1.5 | 5         | Compliance   |
| FRS                 | 8  | 467.5625        | 23.6                     | 0.2 | 0.5       | Compliance   |

## 5.2 Modulation Characteristecs

### 5.2.1 Standard Applicable [FCC Part 95.637(a)(b), Part 2.1047(a) / RSS-210 A6.1.2, A6.2.2]

**Part 95.637(a)** A GMRS transmitter that transmits emission type F3E must not exceed a peak frequency deviation of plus or minus 5 kHz. A FRS unit that transmits emission type F3E must not exceed a peak frequency deviation of plus or minus 2.5 kHz, and the audio frequency response must not exceed 3.125 kHz.

**Part 95.637(b)** Each GMRS transmitter, except a mobile station transmitter with a power output of 2.5 W or less, must automatically prevent a greater than normal audio level from causing over-modulation. The transmitter also must include audio frequency low pass filtering, unless it complies with the applicable paragraphs of § 95.631 (without filtering.) The filter must be between the modulation limiter and the modulated stage of the transmitter. At any frequency ( $f$  in kHz) between 3 and 20 kHz, the filter must have an attenuation of at least  $60 \log_{10}(f/3)$  dB greater than the attenuation at 1 kHz. Above 20 kHz, it must have an attenuation of at least 50 dB greater than the attenuation at 1 kHz.

**Part 2.1047(a)** A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

**RSS-210 A6.1.2 (c)** The peak frequency deviation shall not exceed  $\pm 2.5$  kHz. The limiter shall be followed by a low-pass filter to remove unwanted harmonics.

**RSS-210 A6.2.2 (b)** For emission types F1D, G1D, G3E, F3E or F2D, the peak frequency deviation shall not exceed  $\pm 5$  kHz. GMRS transmitters must include an audio frequency low-pass filter, unless they comply with the appropriate emission masks in Section A6.2.5 below. The filter must be between the modulation limiter and the modulated stage of the transmitter. The filter attenuation must be as follows: for  $3 \text{ kHz} \leq f \leq 20 \text{ kHz}$ , the attenuation is at least  $60 \log_{10}(f, \text{ kHz}/3)$  dB greater than the attenuation at 1 kHz; and for  $f > 20 \text{ kHz}$ , the attenuation is at least 50 dB greater than the attenuation at 1 kHz.

### 5.2.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) °C
- Relative Humidity : (48 ~ 52) % R.H.

### 5.2.3 Measurement Procedure

#### •Modulation Limit

The carrier frequency deviation was measured with the tone adjust the audio input for 60 % of rated system deviation at 1 kHz using this level as a reference (0 dB) and vary the input level from -20 to +20 dB. Record the frequency deviation obtained as a function of the input level at frequencies 0.1, 0.5, 1.0, 3.0 and 5.0 kHz. The maximum deviation was recorded at each test condition.

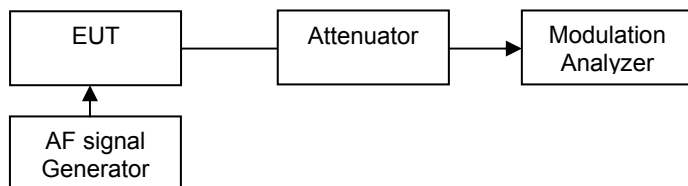
#### • Audio frequency response

The audio input level needed for a particular percentage of modulation was measured in accordance with ANSI/TIA-603-E-2016. Adjust the audio input for 20 % of rated system deviation at 1kHz using this level as a reference. Vary the Audio frequency from 100 Hz to 5 kHz and record the frequency deviation. Audio Frequency Response =  $20 \log_{10}(V_{\text{FREQ}}/V_{\text{REF}})$ .

#### •Audio Low Pass Filter Response

Apply a 1000 Hz tone from the audio signal generator and adjust the level per manufacturer's specifications. Record the dB level of the 1000 Hz tone as  $LEV_{\text{REF}}$ . Set the audio signal generator to the desired test frequency between 3000 Hz and the upper low pass filter limit. Record the dB level at the test frequency as  $LEV_{\text{FREQ}}$ . Calculate the audio frequency response at the test frequency as: low pass filter response =  $LEV_{\text{FREQ}} - LEV_{\text{REF}}$

## 5.2.4 Test setup

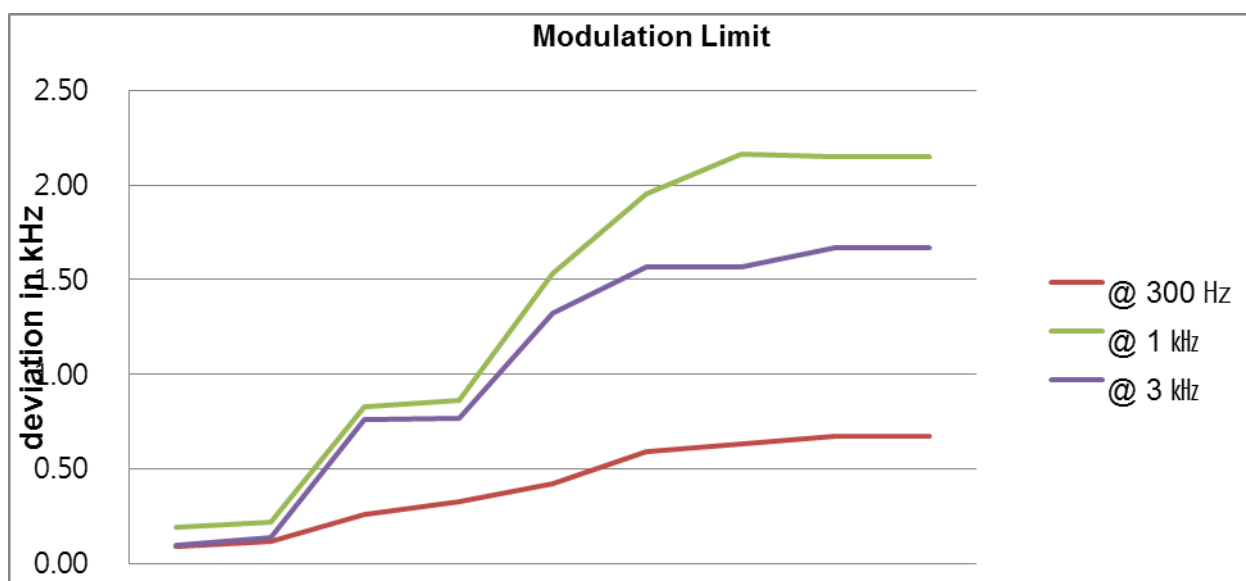


## 5.2.5 Measurement Result

- Modulation Limit

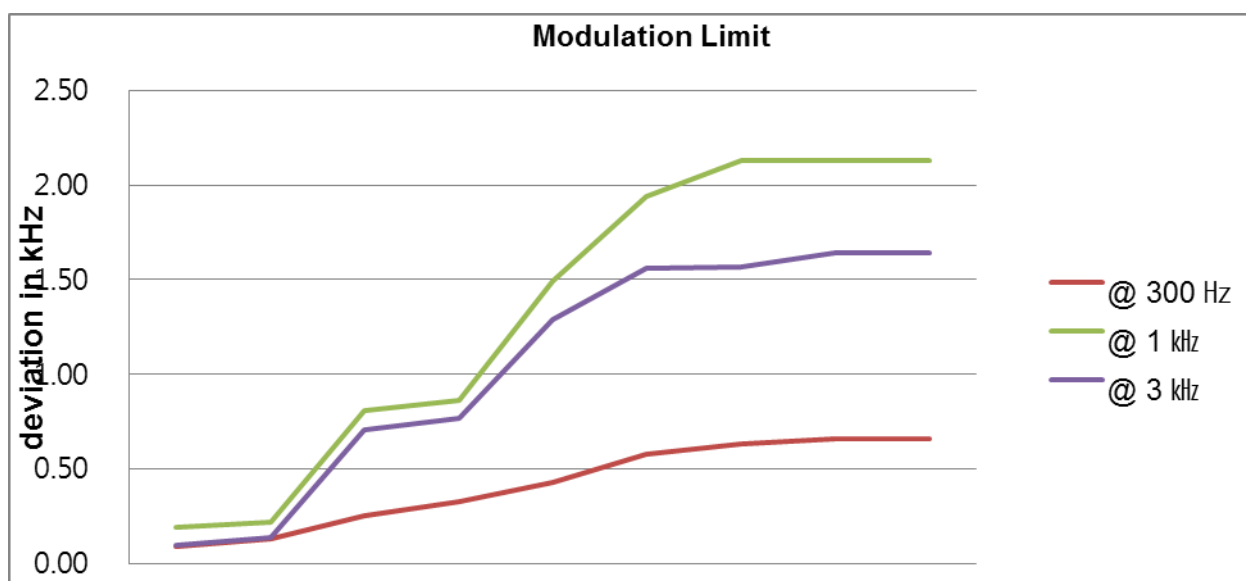
### GMRS (Ch15 : 462.5500 MHz)

| Audio input Level<br>(dB) | Frequency Deviation (kHz) |         |            | Limit<br>(kHz) |
|---------------------------|---------------------------|---------|------------|----------------|
|                           | @ 300 Hz                  | @ 1 kHz | @ 3kHz     |                |
| -20                       | 0.09                      | 0.19    | 0.10       | 5              |
| -15                       | 0.12                      | 0.22    | 0.14       | 5              |
| -10                       | 0.26                      | 0.83    | 0.76       | 5              |
| -5                        | 0.33                      | 0.86    | 0.77       | 5              |
| 0                         | 0.42                      | 1.53    | 1.32       | 5              |
| 5                         | 0.59                      | 1.95    | 1.57       | 5              |
| 10                        | 0.63                      | 2.16    | 1.57       | 5              |
| 15                        | 0.67                      | 2.15    | 1.67       | 5              |
| 20                        | 0.67                      | 2.15    | 1.67       | 5              |
| Test Results              |                           |         | Compliance |                |



**FRS (Ch8 : 467.5625 MHz)**

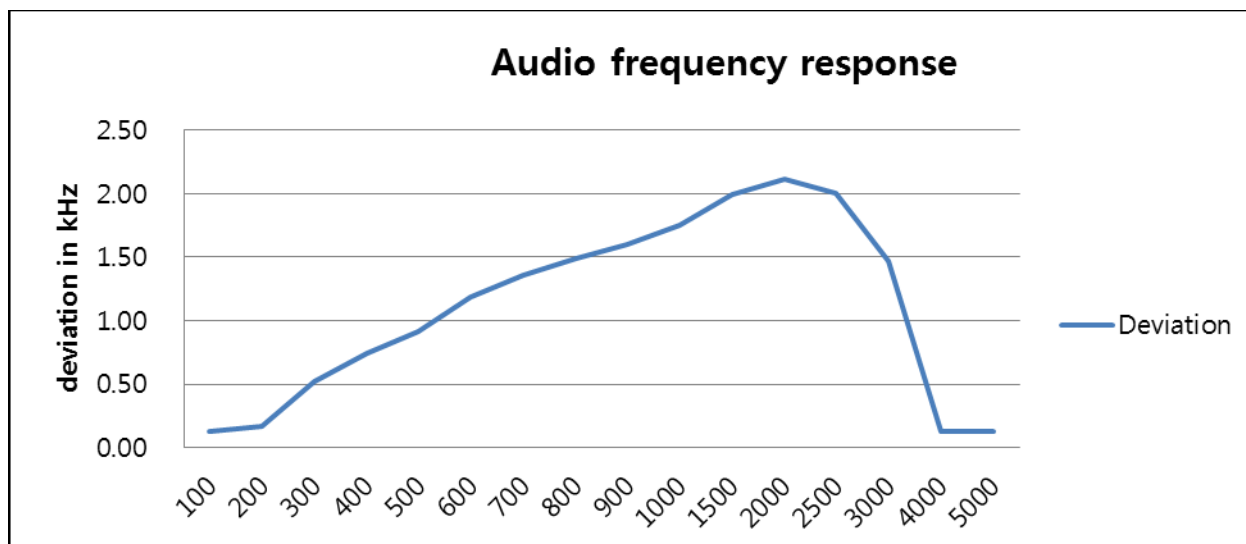
| Audio input Level<br>(dB) | Frequency Deviation (kHz) |            |        | Limit<br>(kHz) |
|---------------------------|---------------------------|------------|--------|----------------|
|                           | @ 300 Hz                  | @ 1 kHz    | @ 3kHz |                |
| -20                       | 0.09                      | 0.19       | 0.10   | 2.5            |
| -15                       | 0.13                      | 0.22       | 0.14   | 2.5            |
| -10                       | 0.25                      | 0.81       | 0.71   | 2.5            |
| 5                         | 0.33                      | 0.86       | 0.77   | 2.5            |
| 0                         | 0.43                      | 1.49       | 1.29   | 2.5            |
| 5                         | 0.58                      | 1.94       | 1.56   | 2.5            |
| 10                        | 0.63                      | 2.13       | 1.57   | 2.5            |
| 15                        | 0.66                      | 2.13       | 1.64   | 2.5            |
| 20                        | 0.66                      | 2.13       | 1.64   | 2.5            |
| Test Results              |                           | Compliance |        |                |



•Audio frequency response

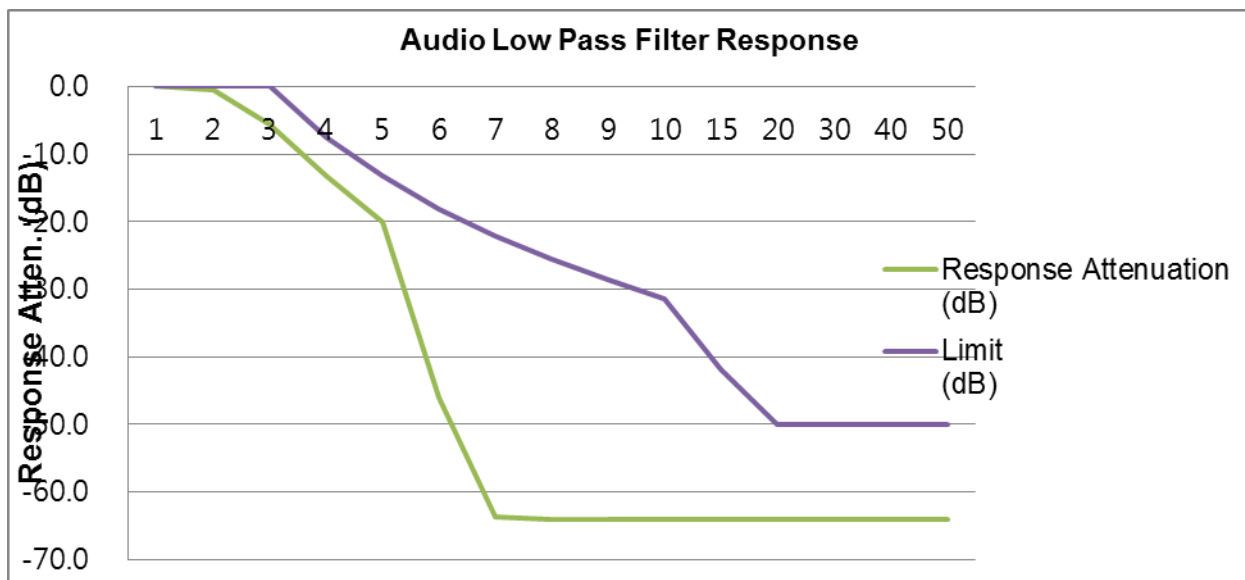
**FRS (Ch8 : 467.5625 MHz)**

| Audio Frequency (Hz) | Frequency Deviation (kHz) | Limit (kHz) |
|----------------------|---------------------------|-------------|
| 100                  | 0.13                      | 3.125       |
| 200                  | 0.17                      | 3.125       |
| 300                  | 0.52                      | 3.125       |
| 400                  | 0.74                      | 3.125       |
| 500                  | 0.91                      | 3.125       |
| 600                  | 1.19                      | 3.125       |
| 700                  | 1.36                      | 3.125       |
| 800                  | 1.49                      | 3.125       |
| 900                  | 1.60                      | 3.125       |
| 1000                 | 1.75                      | 3.125       |
| 1500                 | 1.99                      | 3.125       |
| 2000                 | 2.11                      | 3.125       |
| 2500                 | 2.00                      | 3.125       |
| 3000                 | 1.47                      | 3.125       |
| 4000                 | 0.13                      | 3.125       |
| 5000                 | 0.13                      | 3.125       |
| Test Results         | Compliance                |             |



• Audio Low Pass Filter Response

| Audio Frequency (kHz) | Response Attenuation (dB) | Limit (dB) |
|-----------------------|---------------------------|------------|
| 1                     | 0.0                       | 0          |
| 2                     | -0.6                      | 0          |
| 3                     | -5.7                      | 0          |
| 4                     | -13.2                     | -7.5       |
| 5                     | -20.0                     | -13.3      |
| 6                     | -46.1                     | -18.1      |
| 7                     | -63.7                     | -22.1      |
| 8                     | -64.0                     | -25.6      |
| 9                     | -64.0                     | -28.6      |
| 10                    | -64.0                     | -31.4      |
| 15                    | -64.0                     | -41.9      |
| 20                    | -64.0                     | -50.0      |
| 30                    | -64.0                     | -50.0      |
| 40                    | -64.0                     | -50.0      |
| 50                    | -64.0                     | -50.0      |
| Test Results          |                           | Compliance |



## 5.3 Occupied Bandwidth

### 5.3.1 Standard Applicable [FCC Part 95.633(a)(c), Part 2.1049 / RSS-210 A6.1.3, A6.2.3]

The Emission bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits.

#### **FCC Part 95.633(a) / RSS-210 A6.2.3:**

GMRS: The authorized bandwidth for emission types H1D, J1D, R1D, H3E, J3E and R3E is 4 kHz; for emission types A1D and A3E, it is 8 kHz; and for emission types F1D, G1D, F3E, G3E and F2D, it is 20 kHz.

#### **FCC Part 95.633(c) / RSS-210 A6.1.3:**

FRS: The authorized bandwidth for an FRS unit is 12.5 kHz.

### 5.3.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) °C
- Relative Humidity : (48 ~ 52) % R.H.

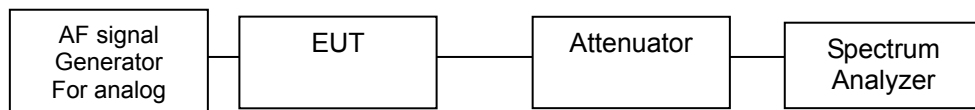
### 5.3.3 Measurement Procedure

1. The EUT was modulated by 2.5 kHz Sine wave audio signal, The level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation. Rated system deviation is 2.5 kHz (12.5 kHz channel spacing).
2. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
3. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. The 99% occupied bandwidth is the frequency bandwidth of the signal power at the 99% channel power of occupied bandwidth.

The spectrum analyzer is set to the as follows :

- RBW : 300 Hz
- VBW : >3 x RBW
- Detector function : peak
- Trace : max hold

### 5.3.4 Test setup

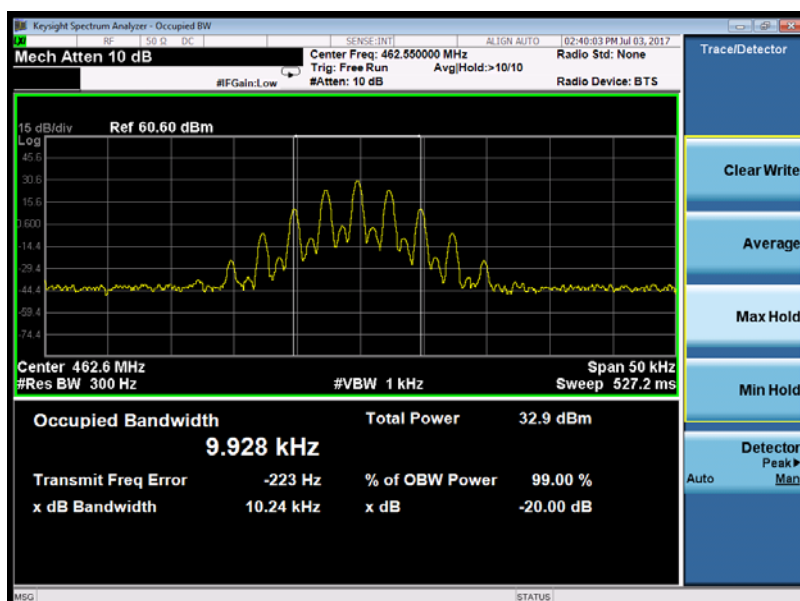


### 5.3.5 Measurement Result

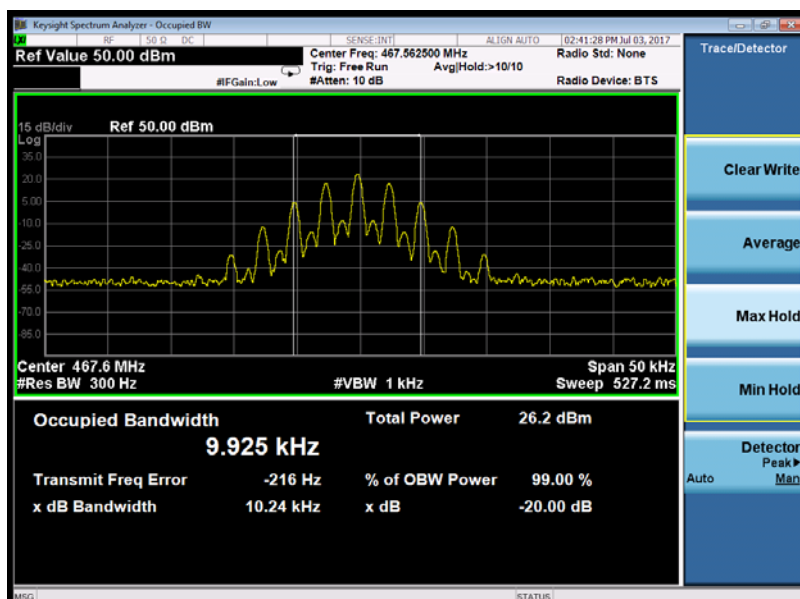
| Channel Description | CH | Frequency [MHz] | 99 % Bandwidth [kHz] | 20 dB Bandwidth [kHz] | Limit [kHz] | Test Results |
|---------------------|----|-----------------|----------------------|-----------------------|-------------|--------------|
| GMRS                | 15 | 462.5500        | 9.93                 | 10.24                 | 20          | Compliance   |
| FRS                 | 8  | 467.5625        | 9.93                 | 10.24                 | 12.5        | Compliance   |

### 5.3.6 Test Plot

GMRS (Ch15 : 462.5500 MHz)



FRS (Ch8 : 467.5625 MHz)



## 5.4 Emission Mask

### 5.4.1 Standard Applicable [FCC Part 95.635(b)(1)(3)(7) / RSS-210 A6.1.5, A6.2.5]

GMRS&FRS: Unwanted emissions shall be attenuated below the unmodulated carrier power in accordance with the following:

- (1) At least 25 dB (decibels) on any frequency removed from the center of the authorized bandwidth by more than 50 % up to and including 100 % of the authorized bandwidth.
- (3) At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100 % up to and including 250 % of the authorized bandwidth.
- (7) At least  $43 + 10 \log_{10}(T)$  dB on any frequency removed from the center of the authorized bandwidth by more than 250 %.

### 5.4.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) °C
- Relative Humidity : (48 ~ 52) % R.H.

### 5.4.3 Measurement Procedure

The EUT was modulated by 2.5 kHz Sine wave audio signal; the level of the audio signal employed is 16 dB greater than that necessary to produce 50 % of rated system deviation. Rated system deviation is 2.5 kHz.

The spectrum analyzer is set to the as follows

- RBW = 300 Hz
- VBW: >3xRBW

### 5.4.4 Test setup

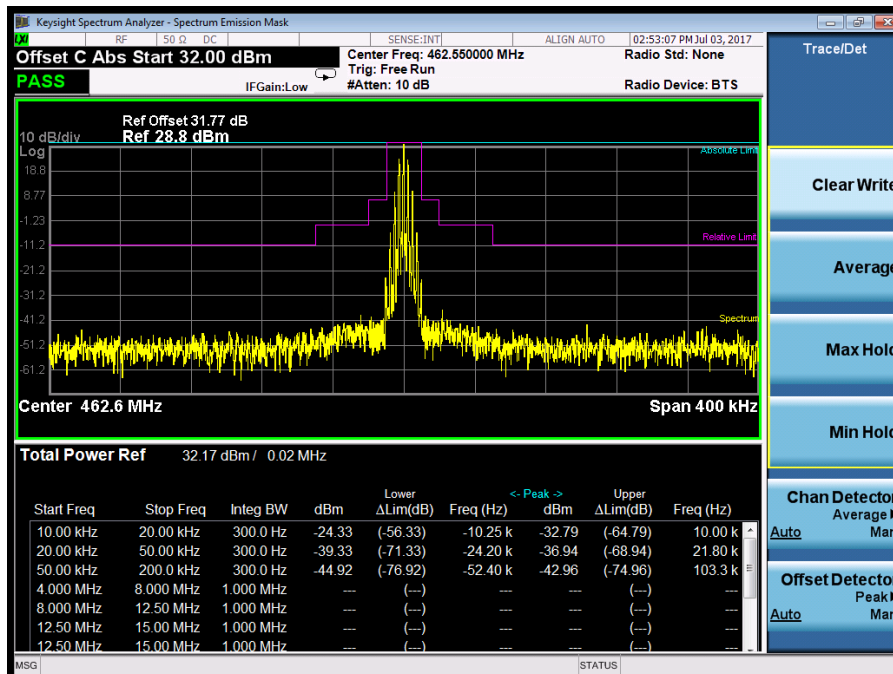
Please refer 5.3.4

### 5.4.5 Measurement Result

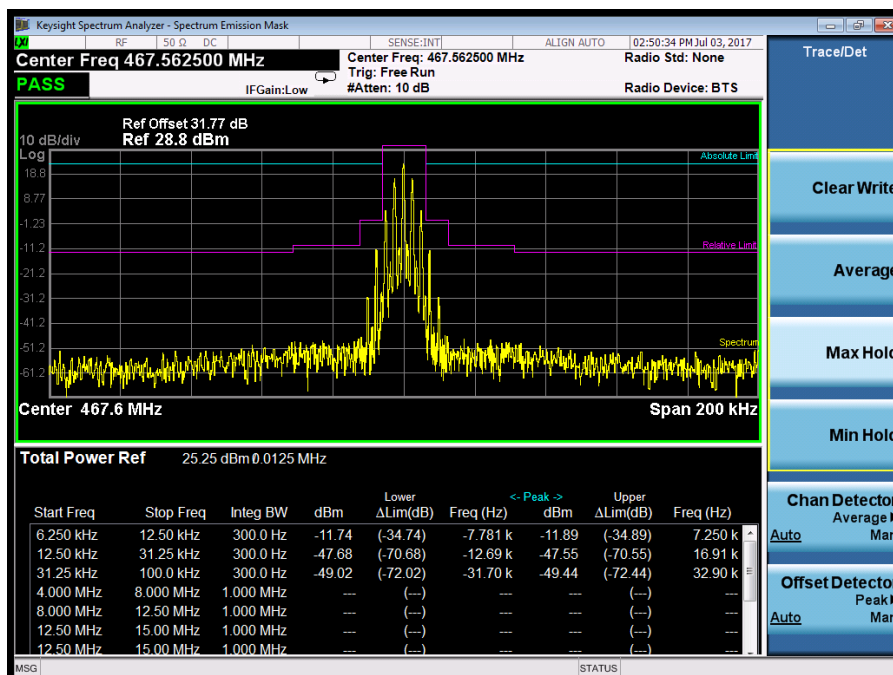
Compliance: please refer 5.4.6 for details

## 5.4.6 Test Plot

### GMRS (Ch15 : 462.5500 MHz)



### FRS (Ch8 : 467.5625 MHz)



Test Results

Compliance

## 5.5 Transmitter Radiated Unwanted Emissions

### 5.5.1 Standard Applicable [FCC Part 95.635(b7) / RSS-201 A6.1.5, A6.2.5]

According to FCC section 95.635(b7), the unwanted emission should be attenuated below TP by at least  $43+10 \log$  (Transmit Power) dB.

### 5.5.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) °C
- Relative Humidity : (48 ~ 52) % R.H.

### 5.5.3 Measurement Procedure

Refer 5.1.3

### 5.5.4 Test Setup

Refer 5.1.4

### 5.5.5 Measurement Result

The following frequencies were selected based on the output power results.

| Channel Description | CH | Freq. [MHz] | ERP power |     |
|---------------------|----|-------------|-----------|-----|
|                     |    |             | [dBm]     | [W] |
| GMRS                | 15 | 462.5500    | 31.8      | 1.5 |

| Emission Frequency [MHz] | Ant Pol | Level below Carrier [dBc] | Margin [dB] | Limit [dBc] | Test Results |
|--------------------------|---------|---------------------------|-------------|-------------|--------------|
| 1 387.5                  | V       | 77.53                     | 32.83       | 44.7        | Compliance   |
| 1 849.2                  | V       | 82.13                     | 37.43       | 44.7        | Compliance   |

**Note:** The formula for limit is below;  
 $43+10 \log (P)$  where, P = EUT's output power in W  
 Therefore  $43+10\log(1.5) = 44.7$

| Channel Description | CH | Freq. [MHz] | ERP power |     |
|---------------------|----|-------------|-----------|-----|
|                     |    |             | [dBm]     | [W] |
| FRS                 | 8  | 467.5625    | 23.6      | 0.2 |

| Emission Frequency [MHz] | Ant Pol | Level below Carrier [dBc] | Margin [dB] | Limit [dBc] | Test Results |
|--------------------------|---------|---------------------------|-------------|-------------|--------------|
| 1 004.2                  | V       | 83.13                     | 47.13       | 36          | Compliance   |
| 1 486.5                  | V       | 85.25                     | 49.25       | 36          | Compliance   |

**Note:** The formula for limit is below;  
 $43+10 \log (P)$  where, P = EUT's output power in W  
 Therefore  $43+10\log(0.2) = 36$

## 5.6 Frequency Stability

### 5.6.1 Standard Applicable [FCC Part 95.621(b), Part 95.627(b) / RSS-210 A6.1.6, A6.2.6]

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

#### FCC Part 95.621(b) / RSS-210 A6.1.6, RSS-210 A6.2.6

GMRS: The carrier frequency tolerance shall be better than  $\pm 5$  ppm.

FRS: The carrier frequency tolerance shall be better than  $\pm 2.5$  ppm.

### 5.6.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) °C
- Relative Humidity : (48 ~ 52) % R.H.

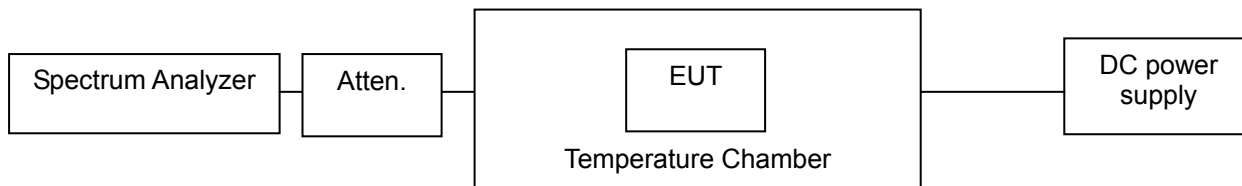
### 5.6.3 Measurement Procedure

EUT connect to Spectrum analyzer, test is performed in T&H chamber.

These measurements shall also be performed at normal and extreme test conditions.

- Test Method : ANSI/TIA-603-E-2016, clause 3.2.2 for frequency stability tests
  - Frequency stability with respect to ambient temperature
  - Frequency stability when varying supply voltage

### 5.6.4 Test setup



### 5.6.5 Measurement Result

#### GMRS (Ch15 : 462.5500 MHz)

| Temp(°C)        | Power Supply  | Measured Freq(MHz) | Freq Drift(ppm) |
|-----------------|---------------|--------------------|-----------------|
| 50              | DC 6.0 (Vnom) | 462.5502           | 0.29            |
| 40              | DC 6.0 (Vnom) | 462.550136         | 0.29            |
| 30              | DC 6.0 (Vnom) | 462.549811         | -0.41           |
| 20              | DC 6.0 (Vnom) | 462.549798         | -0.44           |
| 10              | DC 6.0 (Vnom) | 462.549788         | -0.46           |
| 0               | DC 6.0 (Vnom) | 462.549811         | -0.41           |
| -10             | DC 6.0 (Vnom) | 462.549783         | -0.47           |
| -20             | DC 6.0 (Vnom) | 462.549772         | -0.49           |
| -30             | DC 6.0 (Vnom) | 462.549762         | -0.51           |
|                 |               |                    |                 |
| Nom Temperature | DC 5.4 (Vmin) | 462.549795         | -0.44           |
| Nom Temperature | DC 6.6 (Vmax) | 462.549793         | -0.45           |
| Test Results    |               | Compliance         |                 |

**FRS (Ch8 : 467.5625 MHz)**

| Temp(℃)         | Power Supply  | Measured Freq(MHz) | Freq Drift(ppm) |
|-----------------|---------------|--------------------|-----------------|
| 50              | DC 4.8 (Vnom) | 467.562600         | 0.21            |
| 40              | DC 4.8 (Vnom) | 467.562597         | 0.21            |
| 30              | DC 4.8 (Vnom) | 467.562405         | -0.20           |
| 20              | DC 4.8 (Vnom) | 467.562315         | -0.40           |
| 10              | DC 4.8 (Vnom) | 467.562314         | -0.40           |
| 0               | DC 4.8 (Vnom) | 467.562300         | -0.43           |
| -10             | DC 4.8 (Vnom) | 467.562283         | -0.46           |
| -20             | DC 4.8 (Vnom) | 467.562305         | -0.42           |
| -30             | DC 4.8 (Vnom) | 467.562309         | -0.41           |
|                 |               |                    |                 |
| Nom Temperature | DC 4.3 (Vmin) | 467.562311         | -0.40           |
| Nom Temperature | DC 5.3 (Vmax) | 467.562320         | -0.38           |
| Test Results    |               | Compliance         |                 |